

IV. "On the Continuity of the Protoplasm through the Walls of Vegetable Cells." By WALTER GARDINER, B.A., Scholar of Clare College, Cambridge. Communicated by W. T. THISELTON-DYER, C.M.G., F.R.S. Received December 13, 1883.

Since the communications of November 11th, 1882, and April 16th, 1883, the author has been chiefly employed in testing and improving his methods, and adding to the number of plants in which he has been able to demonstrate the existence of a continuity of the protoplasm between adjacent cells. In certain endosperm cells, *e.g.*, Bentinckia Conda-panna, where the protoplasmic threads traversing the cell walls are particularly well developed, it is possible to see the threads perfectly clearly by merely cutting sections of the endosperm, and mounting them in dilute glycerine. Taking the structure displayed by such a preparation as normal, the author has compared it with the preparations obtained after the action of Chlor. Zinc. Iod. and sulphuric acid. He finds that his method of swelling with Chlor. Zinc. Iod., and staining with Picric-Hoffmann Blue, is in every way perfectly satisfactory, since but little alteration of the structure occurs, and the staining with the Picric-Hoffmann Blue is limited to protoplasm. The sulphuric acid method is in the main unsatisfactory, although it is valuable in the case of thin-walled tissue, where violent swelling must be resorted to; and it is also valuable as affording most conclusive evidence of the existence of a protoplasmic continuity in those cases where the protoplasmic processes of pits cling to the pit-closing membrane. He believes, however, that the results obtained can only be rightly interpreted in the light of the results obtained with Chlor. Zinc. Iod. The possibility of seeing the threads depends upon their degree of tenuity and upon the thickness of the pit-closing membrane, and in extreme cases and in what are by far the more general cases, the only evidence of such perforating threads is afforded by the general staining of the pit-closing membrane. Every transition between clearly defined threads in the substance of the closing membrane and the mere staining of that structure as a whole occurs.

The author has found that in all pitted tissue a pit-closing membrane, which is made evident by staining thin sections with iodine and mounting in Chlor. Zinc. Iod., is uniformly present, and that open pits do not occur. The continuity of the protoplasm is always established by means of fine threads arranged in a sieve-structure, and not by means of comparatively large processes which the occurrence of open pits would necessitate. He cannot therefore agree with observers whose statements necessitate the existence of such open pits.

Since the last communication the author has been able to observe

that a continuity of the protoplasm between adjacent cells occurs in *Dionaea muscipula*, being especially pronounced in the most central layers of parenchymatous cells.

The parenchyma cells of the petioles of certain plants which, as H. von Mohl showed, are often thick walled and conspicuously pitted, afforded favourable material for investigation. In *Aucuba japonica*, and *Prunus lauro-cerasus*, distinct threads could be made out crossing the pit-closing membrane. In *Ilex aquifolium* there was a doubtful striation, and in the rest examined a mere coloration of the pit-membrane.

Examples of continuity have thus been shown to exist in ordinary parenchymatous tissue; and this materially strengthens the belief that the phenomenon of the connexion of cells with one another is one of universal occurrence.

As to the function of the filaments, the author believes that in sieve-tubes and in endosperm-cells they may make possible a transference of solid materials, besides establishing a protoplasmic communication; but in ordinary cells the only significance of the threads is, that by their means the protoplasm of isolated cells becomes connected, and that thus the communication of impulses from one part of the plant to another is insured.

Finally, the presence of these minute perforations of the cell-wall need not lead to any modification of our general ideas as to the mechanics of the cell.

## V. "Note on the Constitution of Chlorophyll." By EDWARD SCHUNCK, F.R.S. Received December 6, 1883.

An examination of some products derived from chlorophyll, which has occupied me for some time, has led to the question of the true nature and constitution of chlorophyll, a question on which widely different opinions prevail. Without entering into matters which concern the physiologist only, it may be said that to the chemist chlorophyll is simply an organic colouring-matter, the substance to which the green colour of leaves and other parts of plants is due. Now colouring-matters are of three kinds. To the first class belong such as occur ready formed and in a free state in vegetable and animal organisms, such as the colouring-matters of turmeric and safflower. The second class comprises those that are formed from colourless chromogens by the combined action of alkalis and oxygen, the colouring-matters of log-wood and archil being well-known examples of this class. These colouring-matters change rapidly when exposed to the further action of oxygen in the presence of alkali, but are quite